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DMSwitch 4000 Series
L2/L3/MPLS Modular Metro Ethernet Switch

FEATURES

- **Modular** and **scalable** family of Metro Ethernet switches
- Full support of NexGen carrier-class services **IPTV**, **HIS**-High Speed Internet and Pseudowire
- Ideal for Ethernet backhaul, Utilities and large corporations and data centers
- Available in 3 models for Core, Aggregation and Access applications
  - **DMSwitch 4008** – 10U high chassis with 2 MPU slots and 8 interface cards slots
  - **DMSwitch 4004** – 6U high chassis with 2 MPU slots and 4 interface cards slots
  - **DMSwitch 4001** – 1U, single slot compact chassis (optional stack ability)
- **MPU**-Main Processing Units supporting **192, 384, 416 and 512 Gbps** switch fabric options
- Extensive range of **Interface Cards**:
  - From **12** up to **48 SFP** ports, Gigabit Ethernet
  - From 2 up to **4 XFP** ports, 10 Gigabit Ethernet
  - From **24** up to **48 10/100/1000BaseT** ports, RJ45, Gigabit Ethernet
  - **Pseudowire** cards with up to **32 x E1** or up to **4 x STM-1** ports
- **Wire-Speed**, hardware-based L2/L3 and MPLS packet switching
- Advanced IP and MPLS services provisioning – L2 and L3 VPN over MPLS
- **Powerful management** – centralized **FCAPS**-Fault, Configuration, Accounting, Performance and Security, available through DATACOM's **DMView** NMS
- Advanced **QoS** and **H-QoS** features providing up to 8 queues per port and prioritization according to VLAN, DSCP, IP Precedence and TCP/UDP ports.
- Robust security mechanisms ensuring management and traffic distribution along the network.
- VLAN support using all **4096 VLANs** defined in IEEE 802.1Q. Supports **Q-in-Q** double tagging.
- **L2** and **L3 Multicast** on hardware. Support of **IGMP** and **PIM** with hardware-based encapsulation
- System redundancy and reliability. MPU redundancy, dual power supply, passive backplane and fail-safe topologies for interface cards
- **DMView** platform for multi-platform, multi-user carrier-class NMS. End-to-end Provisioning and OAM-Operations Administration and Maintenance.
- The **DMSwitch 4000** series is complemented by DATACOM's **DMSwitch 4100, 3000, 2000** series and the field technician Metro Ethernet tester, **iTi900ETH**

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DESCRIPTION

- **Wire-speed L2, L3 and MPLS**: with a switch fabric of up to 512 Gbps, all packet switching is done on Hardware at wire-speed, guaranteeing low latency no performance degradation. On Software, the level 2 and 3 protocols are built in order to mount MAC tables, IP routes and MPLS *push/pop/swap* tables.

- **IP/MPLS Applications**: The **DMSwitch 4000 series** supports static and dynamic routing – RIPv2, OSPFv2 and BGPv4. Dedicated versions also support MPLS LER (Label Edge Routing) and LSR (Label Switch Routing) switching. Over MPLS infrastructure it's possible to establish LSPs, MPLS tunnels, through LDP or RSVP-TE protocols, supporting FRR. LDP tunneling over RSVP is also supported. Implementation of TLS (Transparent LAN Services) is possible through L2 VPN and/or L3 VPN over MPLS. VPNs are configurable point-to-point (VPWS), point-multipoint (VPLS), and also H-VPLS (*meshed* and *hub-spoken* modes). LSPs (MPLS tunnels) may be established over GbE (electrical/optical), 10 GbE (XFP) and 802.3ad (LAG) interfaces.

- **Chassis**: The **DMSwitch 4000 series** supports up to 8 interface cards and 2 hot-swap MPU modules. It uses a passive backplane and redundant power supply sources. Connection between MPU and Interface cards uses a failure-safe topology that ensures full redundancy for data paths. The system is distributed and modular, both in hardware (data) and software (control) levels. Each interface card is equipped with a CPU, memory and its own cross-switch in order to work either in the stand alone system (**DMSwitch 4001**) or in the chassis distributed platforms (**DMSwitch 4004** and **4008** with MPUs). The **DMSwitch 4001** is also available with stack option.

- **Software:** DATACOM switches software architecture is based on a modular platform, both in application and operation levels. This way it's possible to reset software processes individually and to define different priorities for critical processes, among other possibilities. Control is done separately from routing in such a way traffic is not affected by control flows. Control level protocols define the configuration actions that will be transferred to the hardware of the device running the functions at wire-speed. Software processing is split into the main processor unit and the card processor. Packets are routed in a distributed way between the interface cards and the MPU. Local traffic does not require switching via MPU. Traffic between interface cards will be routed through the MPU and from there to final destination port.

- **Management**: Complete Centralized **FCAPS** is available through the **DMView** platform, over Windows or Solaris. The **DMSwitch 4000 series** is also configured using CLI-Command Line Interface with automatic syntax help and automatic commands completion. Access is possible through SSH, Telnet, RS232 Console or Ethernet management port. An internal WEB server is available, with SSL, as well as SNMPv1/2/3/4 agent and up to 4 RMON groups. The **DMSwitch 4000 series** allows creation of complex ACLs-Access Control Lists, with multiple parameters for comparison and action, allowing modification, discarding, routing and prioritization of packets. A variety of tools for network and infrastructure cabling diagnostics are available. 2 Firmware's and up to 10 configurations can be saved on the device, choosing each one of them to be used on initialization.

- **Advanced QoS**: The **DMSwitch 4000 series** supports up to 8 queues per port, with prioritization algorithms allowing the definition of which data flow should have lower/higher priority, configure weights per each queue, define minimal data rates for forwarding or any combination of those tools. Classification is performed using VLANs, port or IEEE 802.1p, IP Precedence fields or DSCP, TCP ports and UDP among others, up to Layer 7 traffic level. Bandwidth control configurable in steps of 64 Kbps on the CIR-*Committed Information Rate* and on the PIR-*Peak Information Rate*, and it can be applicable on incoming/outgoing traffic or a specific packet flow through filters.

- **Robust Security**: The **DMSwitch 4000 series** is available with mechanisms to guarantee the operation and maintenance of the install-base. It supports encryption on the communication protocols and filters to define from which devices administration access is allowed. Using local and Remote Syslog, Authentication, Accounting and Authorization (AAA) of users through RADIUS and TACACS+, alarms per email, SNTP DoS protection and authentication per port using IEEE 802.1x it's

possible to build a trustworthy management structure. For Metro Ethernet applications tools as limiting MAC address per port and per VLAN, L2 and L3 protection protocols against network attacks, bandwidth limiting for broadcast, multicast and DLF-*Destination Lookup Failure* traffic are available.

- **VLANs**: The DMSwitch 4100 supports simultaneously the totality of 4096 VLANs defined in IEEE 802.1Q, offering also double tagging (Q-in-Q). VLANs are defined per protocol, per MAC address and per IP-Subnet, and finally dynamically using the GVRP protocol.

- **Protection Mechanisms**: In terms of **L2**, Spanning Tree protocols are available, including RSTP with shorter convergency times, Per-VLAN STP and MSTP for better utilization of resources and scalability. **EAPS** and **ERPS (*)** protocols are also supported for sub-50ms Ethernet ring topologies and for topologies requiring Pseudowire transport. The **DMSwitch 4000 series** also supports link aggregation, grouping physical ports, with load balancing and recovery time of sub-200ms. Those tools allows configuration of Metro Ethernet applications with protection, robustness and fast failure recovery. For **L3/MPLS**, the devices have a failure device mechanism through: Ethernet OAM, BFD and RSVP- FRR

- **L2/L3 Multicast**: L2 and L3 Multicast applications are supported through 1024 L2 groups and up to 4096 L3 groups, IPv4, **IGMP v1/v2/v3** snooping and query protocol and **PIM** protocol are supported. PIM-SM with hardware support for PIM-Register messages according to RFC4601, and function PIM-SSM according to RFC4607. DR election and static r via BootStrap RP configurations are supported as well.

- **OAM Ethernet**: The DMSwitch 4000 series support end-to-end OAM (CFM) according to IEEE 802.3ag and ITU-T Y.1731 standards. This enables proactively monitoring of the connectivity (Continuity Check) and isolation of faults through Loopback Messages (Ping L2) and Linktrace Messages (Traceroute L2). Unidirectional and bi-directional Frame Delay and Frame Delay variation measurements enable performance monitoring. Point-to-point OAM (EFM) according to IEEE 802.3ah is also supported. This enables fault indications, including Dying Gasp, Unidirectional Link and Critical Event. EFM operates with a configurable interval between PDUs, for interoperability with other vendors.

- **Pseudowire**: Designed to meet the convergence applications of services deployed for the new packet network, the DMSwitch 4000 series is available with Pseudowire (PWE3) interface cards for emulation of attributes, essential for the convergence of TDM-based services. Circuit emulation is performed on E1 channels and on STM-1 optical ports.

- **PTP (*)**: Precision Time Protocol – Aiming to meet rigid operators requirements for network synchronization, the DM 4000 series utilizes the PTP (Precision Timing Protocol) technology as per recommendation IEEE 1588v2 (2008). The DMSwitch 4000 can operate as Master or Slave of the PTP connection. In master mode, the device allows the connection to an external synch source.

(*) Contact DATACOM Marketing Sales manager for availability

DMSwitch 4004

SPECIFICATIONS
Hardware

	DM4000 ETH12GX	DM4000 ETH24GX	DM4000 ETH2x10GX	DM4000 ETH12GX+1x10GX	DM4000 ETH48GX H Series
Switch L2	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
Router L3	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
QoS	L2-L4	L2-L4	L2-L4	L2-L4	L2-L4
MPLS	LER/LSR	LER/LSR	LER/LSR	LER/LSR	LER/LSR
Ports	12 x 1000Base-X (SFP)	24 x 1000Base-X (SFP)	2 x 10G (XFP)	12 x 1000Base-X (SFP) + 1 x 10G (XFP)	48 x 1000Base-X (SFP)
MAC address table	512k[2]	512k[2]	512k[2]	512k[2]	512k[2]
L3 hosts (IPv4)	32k[2]	32k[2]	32k[2]	32k[2]	16k[2]
L3 hosts (IPv6)	16k[2]	16k[2]	16k[2]	16k[2]	8k[2]
L3 Routes (IPv4)	240k[2]	240k[2]	240k[2]	240k[2]	512k[2]
L3 Routes (IPv6)	240k[2]	240k[2]	240k[2]	240k[2]	512k[2]
L2 Multicast groups	1k[2]	1k[2]	1k[2]	1k[2]	1k[2]
L3 Multicast groups (IPv4)	4k[2]	4k[2]	4k[2]	4k[2]	4k[2]
L3 Multicast groups (IPv6)	4k[2]	4k[2]	4k[2]	4k[2]	4k[2]
Filter Rules	4k	4k	4k	4k	256k[2]
TDM PWE3	Not available	Not available	Not available	Not available	Not available
IEEE1588-2008	Not available	Not available	Not available	Not available	YES[1]

	DM4000 ETH24GX+2x10GX H Series	DM4000 ETH24GX H Series	DM4000 ETH24GX L Series	DM4000 ETH2x10GX H Series	DM4000 ETH4x10GX H Series
Switch L2	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
Router L3	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
QoS	L2-L4	L2-L4	L2-L4	L2-L4	L2-L4
MPLS	LER/LSR	LER/LSR	LER/LSR	LER/LSR	LER/LSR
Ports	24 x 1000Base-X (SFP) + 2 x 10G (XFP)	24 x 1000Base-X (SFP)	24 x 1000Base-X (SFP)	2 x 10G (XFP)	4 x 10G (XFP)
MAC address table	512k[2]	512k[2]	32k[2]	512k[2]	512k[2]
L3 hosts (IPv4)	16k[2]	16k[2]	16k[2]	16k[2]	16k[2]
L3 hosts (IPv6)	8k[2]	8k[2]	8k[2]	8k[2]	8k[2]
L3 Routes (IPv4)	512k[2]	512k[2]	16k[2]	512k[2]	512k[2]
L3 Routes (IPv6)	512k[2]	512k[2]	8k[2]	512k[2]	512k[2]
L2 Multicast groups	1k[2]	1k[2]	1k[2]	1k[2]	1k[2]

L3 Multicast groups (IPv4)	4k[(2)]	4k[(2)]	4k[(2)]	4k[(2)]	4k[(2)]
L3 Multicast groups (IPv6)	4k[(2)]	4k[(2)]	4k[(2)]	4k[(2)]	4k[(2)]
Filter Rules	256k[(2)]	256k[(2)]	8k[(2)]	256k[(2)]	256k[(2)]
TDM PWE3	Not available	Not available	Not available	Not available	Not available
IEEE1588-2008	YES[(1)]	YES[(1)]	YES[(1)]	YES[(1)]	YES[(1)]

	DM4000 ETH4x10GT-CX4	*DM4000 ETH24GT*	*DM4000 ETH48GT*	*DM4000 PWE3 ETH10xGX+32E1*	*DM4000 PWE3 ETH10xGX+4STM1*
Switch L2	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
Router L3	Wire Speed	Wire Speed	Wire Speed	Wire Speed	Wire Speed
QoS	L2-L4	L2-L4	L2-L4	L2-L4	L2-L4
MPLS	LER/LSR	Not available	Not available	LER/LSR	LER/LSR
Ports	4 x CX4 (IEEE 802.3ak)	24 x 10/100/1000 Base-TX	48 x 10/100/1000Base-TX	10 x 1000Base-X (SFP) + 32 x E1 (G703)	10 x 1000Base-X (SFP) + 4 x STM1 (SFP)
MAC address table	512k[(2)]	16k	16k	512k[(2)]	512k[(2)]
L3 hosts (IPv4)	16k[(2)]	8k	8k	32k[(2)]	32k[(2)]
L3 hosts (IPv6)	8k[(2)]	4k	4k	16k[(2)]	16k[(2)]
L3 Routes (IPv4)	512k[(2)]	12k	12k	240k[(2)]	240k[(2)]
L3 Routes (IPv6)	512k[(2)]	6k	6k	240k[(2)]	240k[(2)]
L2 Multicast groups	1k[(2)]	1k[(2)]	1k[(2)]	1k[(2)]	1k[(2)]
L3 Multicast groups (IPv4)	4k[(2)]	1k[(2)]	1k[(2)]	4k[(2)]	4k[(2)]
L3 Multicast groups (IPv6)	4k[(2)]	1k(2)	1k(2)	4k[(2)]	4k[(2)]
Filter Rules	256k[(2)]	2k	2k	4k	4k
TDM PWE3	Not available	Not available	Not available	SAToP / CESoPSN	SAToP / CESoPSN
IEEE1588-2008	YES[(1)]	Not available	Not available	YES	YES

(1) Check with DATACOM's Marketing and Helpdesk for HW/SW support of these features
(2) Maximum Values – due to resource sharing, in some cases a lower value may be obtained
(3) In this configuration matrix will present Blocking!

Software

Features	Details
Flow Control	*Backpressure on Half-duplex; PAUSE (IEEE 802.3x) in Full-duplex*
Auto-Negotiation	*Speed, duplex mode, flow control and MDI/MDIX*
Management	***CLI** via Telnet, SSH (server) and Console* ***ACL Configuration** with multiple Actions and Comparisons* ***Telnet** (Client and Server)* ***SSH** Server* ***Action Scheduling** and Export info via XML* *Management via GUI – **DMView*** ***Remote Management** through DMSwitch 4000/3000* ***SNMP v1/v2/v3/v4*** ***RMON** groups 1,2,3 and 9* *Network diagnostic tools (**Telnet**, **Traceroute** and **Ping**)*

	Cabling Diagnostics Tools *Firmware upgrade on flash through **TFTP** or **DMView*** *Access Levels for management of groups and users* *Up to **10 configurations** on flash, **2 firmwares**, with upload/download via TFTP or HTTP/HTTPS* *Ethernet **OAM** (**EFM**-802.3ah; **CFM**-802.1ag and **Y.1731**)* ***LLDP**-Link Layer Discovery Protocol (IEEE 802.1ab)* ***DHCP Relay** (option 82)* *Static or Dynamic IP address (**DHCP/BOOTP**)*
Security	*MAC address limiting configurable per port and per VLAN* ***Port Authentication** (IEEE 802.1x) with Guest VLAN, Restricted VLAN and VLAN Assignment* *Local and Remote **Syslog*** ***AAA**-Authentication, Authorization and Accounting with TACACS+ and RADIUS* ***DoS**-Denial of Service protection tools* ***SMTP** – E-mail notifications* ***HW filters** for Access Control SNMP, WEB, Telnet and SSH* ***SNTP***
VLAN	*Up to **4094 VIDs** simultaneous tagging – IEEE 802.1q* *Port-based, with port overlapping option* *Protocol-based (IEEE 802.1v), MAC-based and IP-Subnet based* ***Q-in-Q** double tagging, and selective Q-in-Q* ***VLAN translate** – up to 16 translations* ***Private VLAN*** *Dynamic VLAN (**GVRP**)*
Protection	*Classic Spanning Tree (IEEE 802.1d)* *Rapid Spanning Tree (IEEE 802.1w), also Per-VLAN RSTP* *Multiple Spanning Tree (IEEE 802.1s)* ***EAPS** v1 and **ERPS** (ITU-T G.8032)* ***BPDU** Guard* *Link Flap Detection; Loopback Detection* *Backup Link*
QoS	***8 queues per port*** ***TCI** tagging (IEEE 802.1p)* *IP Precedence / TOS or DSCP / TOS* ***MAC** classification; **Source/Destination IP** classification* ***TCP** or **UDP** ports* *Filter with generic match (L2 to L7)* ***Rate-Limit** (Ingress and Egress), with 8 Kbps granularity per port and per flow* ***Traffic Shaping** – CIR and PIR definition* ***WRR**-Weighted Round Robin; **WFQ**-Weighted Fair Queuing* ***RR**-Round Robin and **SP** Strict Priority with queue scheduling algorithms* *Hierarchical QoS (**HQoS**)* ***WRED** with 2 configurations, per profile and out-of-profile*
Link Aggregation	***Static** or **Dynamic** configuration through **LACP** (IEEE 802.3ad)* ***32 logical groups,** with up to 8 active ports per group* *Use equivalent of non-aggregated links for L3, MPLS, QoS functions* *Configurable **Load Balancing** criteria (per-IP, per-MAC, etc…)*
L2 Functionalities	*Maximum rate of **Broadcast**, **Multicast** and **DLF**, controlled per-port* ***Head of Line Blocking** protection* *Support of **Jumbo Frames** (up to 9K)* ***IGMP v1/v2/v3**. Snooping and query functions* ***Global Ageing** L2 or by VLAN* ***Tunneling of L2** protocols* *Disabling of MAC learning per-port or per-VLAN* ***Traffic monitor** for ports and/or packet flows*
L3 Routing	*Static Routing; **RIP** v1/v2; **OSPF** v2/v3; **BGP** v4, and sub-net support* *Redundancy via **VRRP*** ***PIM** (SM, SSM)* ***Proxy ARP*** ***VRF Lite***
MPLS	***VPWS** – L2 VPN over MPLS (**Draft Martinni**)* ***VPLS** – Virtual LAN services and **H-VPLS** – Hierarchical VPLS* ***LDP**-Label Distribution Protocol* ***RSVP-TE** – Resource Reservation Protocol-Traffic Engineering with **FRR**-Fast ReRoute* *Mapping between **802.1p**, **DSCP** and **EXP Field** of MPLS* ***BGP/VPN** – L3 VPN over MPLS (RFC 2547/4364)*

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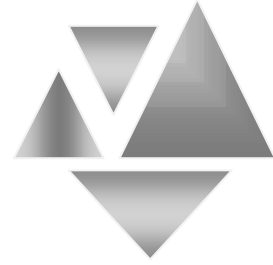
APPLICATIONS

Fig.1 – Complete Metro Ethernet Solution – MPLS/L3/L2 on 10 GbE and 1 GbE Rings
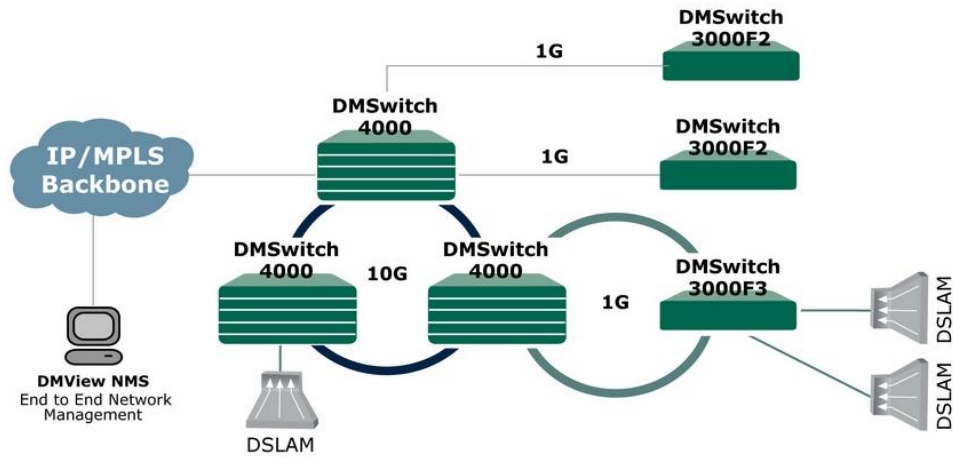

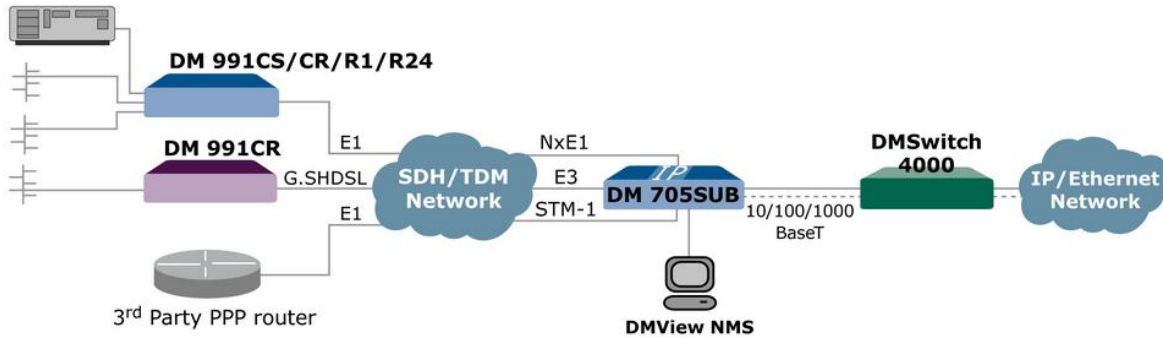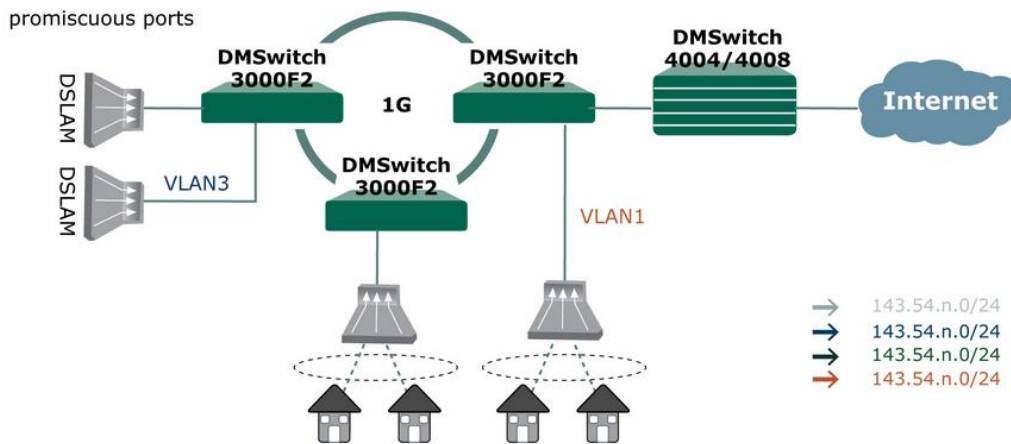*Fig.2– Legacy and NexGen IP-centric services – Pseudowire convergence*

Fig.3– DSLAM Connectivity – Copper access for NexGen IP-centric services

DMSwitch 4001

MPUs & ACCESSORIES

DM4000 MPU192	Main Processing Unit - Main CPU and switch fabric of **192 Gbps**. Supports redundancy. Handles up to 8 interface cards at 24 Gbps each (up to 12 GbE wire-speed interfaces per module) or up to 4 interface cards at 48 Gbps each (up to 24 GbE wire-speed interfaces per module)
DM4000 MPU384	Main Processing Unit - Main CPU and switch fabric of **384 Gbps**. Supports redundancy. For **H-Series** interface cards the same hardware operates at higher wire-speed, reaching up to **416 Gbps**. Handles up to 8 interface cards at 48 Gbps each (up to 24 GbE wire-speed interfaces per module) or up to 4 interface cards at 96 Gbps each (up to 48 GbE wire-speed interfaces per module)
DM4000 MPU416	Main Processing Unit - Main CPU and switch fabric of **416 Gbps**. Supports redundancy. Handles up to 8 interface cards at 52 Gbps each (up to 26 GbE wire-speed interfaces per module) or up to 4 interface cards at 104 Gbps each (up to 52 GbE wire-speed interfaces per module)
DM4000 MPU512	Main Processing Unit - Main CPU and switch fabric of **512 Gbps**. Supports redundancy. Handles up to 8 interface cards at 64 Gbps each (up to 32 GbE wire-speed interfaces per module) or up to 4 interface cards at 128 Gbps each (up to 64 GbE wire-speed interfaces per module)
DM4001 chassis	1U high chassis, capable of handling 1 interface card. The chassis has dual power input. Optionally supports stacking.
DM4004 chassis	6U high chassis, capable of handling 4 interface cards, 2 redundant MPU modules, 2 GPC modules, one FAN module and double power input. The backplane performs interconnection for data traffic and management module.
DM4008 chassis	10U high chassis, capable of handling 8 interface cards, 2 redundant MPU modules, 2 GPC modules, one FAN module and double power input. The backplane performs interconnection for data traffic and management module.
DM4000 GPC-OAB	Active doped fiber amplifier module. Amplifies optical signal enabling long-range 10 Gbps links
DM4000 GPC-OAP	Active doped fiber pre-amplifier module. Amplifies attenuated optical signals for detection at the receive end, for long-range 10 Gbps links
DM4000 GPC-DCM	Chromatic dispersion compensation passive module. To be used with boosters or pre-amplifiers in long-range optical links, up to 10 Gbps.
DM4000 PSU-SB19-1U-3M	1U high, 19" subrack for modular power supplies - DC to AC rectifier
DM4000 PSU-Mod400	Power supply module for PSU-SUB19. Input 93-253VAC, output 48VDC, 400W power, hot-swap
RB13-BNC/IEC/RJ45	Patch panel for 32 x E1 (available in 3 versions: 75OHM-BNC; 75OHM-IEC; 120OHM-RJ45)
LFH-160	LFH-to-LFH-160 cable for RB13 panel. Available also with one open end.

PARTIAL STANDARTS LIST

IEEE	802.1ab Link Layer Discovery Protocol (LLDP) 802.1ad Provider Bridges 802.1ag Connectivity FaultManagement(CFM) 802.1d Bridging 802.1p Priority Support 802.1q Virtual LAN 802.1q-in-q VLAN Stacking 802.1s Multiple Spanning Tree (MSTP) 802.1x Port Security 802.1w Rapid Spanning Tree 802.3 10 BASE T 802.3ab 1000 BASE T 802.3ac Extension for VLAN Tagging 802.3ad Link Aggregation (LAG) 802.3ah Ethernet First Mile (EFM) 802.3ae 10G BASE-SR/LR/ER/SW/LW/EW 802.3i 10BASE-T 10 Mbit/s (1.25 MB/s) 802.3u 100 BASE TX 802.3x Flow Control 802.3z 1000 BASE SX/LX 1588-2008 Precision Clock Synchronization Protocol (PTP)	**IETF**	RFC854 Telnet Protocol Specification RFC1305 Network Time Protocol (V3) Specification, Implementation and Analysis RFC1492 An Access Control Protocol, Sometimes Called TACACS RFC1812 Requirements for IP Version 4 Routers (Ipv4) RFC2030 Simple Network Time Protocol (SNTP) RFC2138 Remote Authentication Dial In User Service (RADIUS) RFC2139 RADIUS Accounting RFC2544 Benchmarking Methodology for Network Interconnect Devices RFC2865 Remote Authentication Dial In User Server (RADIUS) RFC3021 Using 31-Bit Prefixes on IPv4 Point-to-Point Links RFC3164 The BSD Syslog Protocol RFC3619 Ethernet Automatic Protection Switching (EAPS) v1 RFC4250 The Secure Shell (SSH) Protocol Assigned Numbers RFC4251 The Secure Shell (SSH) Protocol Architecture RFC4252 The Secure Shell (SSH) Authentication Protocol RFC4253 The Secure Shell (SSH) Transport Layer Protocol RFC4254 The Secure Shell (SSH) Connection Protocol

ITU-T	Y.1731 OAM functions and mechanisms for Ethernet based networks	MEF	MEF 9 - Abstract Test Suite for Ethernet Services at the UNI MEF 14 - Abstract Test Suite for Traffic Management Phase 1
Routing	RFC1723 RIP Version 2 - Carrying Additional Information RFC1997 BGP Communities Attribute RFC2082 RIP Version 2 MD5 Authentication RFC2154 OSPF with Digital Signatures RFC2328 OSPF Version 2 RFC2329 OSPF Standardization Report RFC2338 Virtual Router Redundancy Protocol RFC2370 The OSPF Opaque LSA Option RFC2385 Protection of BGP Sessions via the TCP MD5 Signature Option RFC2453 RIP Version 2 RFC2796 BGP Route Reflector An Alternative to Full Mesh BGP RFC2842 Capabilities Advertisement with BGP-4 RFC2858 Multiprotocol Extensions for BGP-4 RFC2918 Route Refresh Capability for BGP-4 RFC3021 Using 31-Bit Prefixes on IPv4 Point-to-Point Links RFC3065 Autonomous System Confederations for BGP RFC3101 The OSPF NSSA Option RFC3107 Carrying Label Information in BGP-4 RFC3137 OSPF Stub Router Advertisement RFC3392 Capabilities Advertisement with BGP-4 RFC3623 Graceful OSPF Restart RFC3630 Traffic Engineering (TE) Extensions to OSPF Version 2 RFC3768 Virtual Router Redundancy Protocol (VRRP) RFC4271 A Border Gateway Protocol 4 (BGP-4) RFC4360 BGP Extended Communities Attribute RFC4724 Graceful Restart Mechanism for BGP RFC4760 Multiprotocol Extensions for BGP-4 RFC4893 BGP Support for Four-octet AS Number Space RFC5065 Autonomous System Confederations for BGP RFC5250 The OSPF Opaque LSA Option RFC5291 Outbound Route Filtering Capability for BGP-4[1] RFC5396 Textual Representation of Autonomous System (AS) Numbers RFC5492 Capabilities Advertisement with BGP-4	**MPLS**	RFC2205 RSVP v1 Functional Specification RFC2547 BGP/MPLS Virtual Private Network RFC2702 Requirements for traffic engineering over MPLS RFC2961 RSVP Refresh Overhead Reduction Extensions RFC3031 MPLS architecture RFC3032 MPLS label stack encoding RFC3036 LDP specification RFC3037 LDP applicability RFC3209 Extensions to RSVP for LSP tunnels RFC3210 Applicability statement for extensions to RSVP for LSP Tunnels RFC3215 LDP state machine RFC3270 Multi-protocol label switching (MPLS) support of differentiated services RFC3443 TTL processing in multiprotocol label switching (MPLS) networks RFC3469 Framework for MPLS-based recovery RFC3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3) RFC3985 Pseudo Wire Emulation Edge-to-Edge (PWE3) Architecture RFC4090 Fast reroute extensions to RSVP-TE for LSP tunnels RFC4182 Removing a restriction on the use of MPLS explicit NULL RFC4221 MPLS management overview RFC4364 BGP/MPLS IP Virtual Private Networks (VPNs) RFC4377 OAM Requirements for MPLS Networks RFC4378 A framework for MPLS Operation and Management RFC4446 IANA Allocations for Pseudowire Edge to Edge Emulation (PWE3) RFC4447 Pseudowire Setup and Maintenance Using the LDP RFC4448 Encapsulation methods for transport of Ethernet over MPLS RFC4664 Framework for L2VPNs RFC4665 Service Requirements for Layer 2 Provider-Provisioned VPN RFC4762 Virtual Private LAN Service (VPLS) Using LDP Signaling RFC4906 Transport of Layer 2 Frames Over MPLS RFC5036 LDP Specification
Multicast	RFC1112 Host extensions for IP multicasting RFC2236 Internet Group Management Protocol, v2 RFC3376 Internet Group Management Protocol, v3 RFC3569 An Overview of Source-Specific Multicast (SSM) RFC4541 Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches RFC4601 Protocol Independent Multicast – Sparse Mode (PIM-SM) RFC4604 Using IGMP Version 3 for Source Specific Multicast RFC4607 Source-Specific Multicast for IP RFC4608 Source-Specific Protocol Independent Multicast in 232/8	**QoS**	RFC2309 Queue Management and Congestion Avoidance in the Internet RFC2474 Definition of the differentiated services field (DS) in Ipv4 RFC2475 An architecture for differentiated services RFC2597 Assured Forwarding PHB Group RFC2598 An Expedited Forwarding PHB RFC2697 A single rate three color marker RFC2698 A two rate three color marker RFC3140 Per hop behavior identification codes RFC3246 An expedited forwarding PHB RFC3644 Policy quality of service (QoS) Information model RFC3670 Information model for describing network device QoS data path mechanism
PWE3	RFC4553 Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP) RFC5086 Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)		

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